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(54) MULTI-COLOR PIGMENT SENSITIZING TRANSPARENT SEMICONDUCTOR ELECTRODE MEMBER AND ITS MANUFACTUREMULTI-COLOR PIGMENT SENSITIZATION TYPE SOLAR BATTERYAND DISPLAY ELEMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a solar battery of pigment sensitizing type in which a plurality of colors are arranged in a plurality of parts of a display elementsign boardetc.
SOLUTION: This solar battery comprises a first transparent electrode 101a transparent semiconductor layer 102 provided on the first electrode 101a sensitizing pigment adsorption part for a plurality of colors adsorped in a plurality of parts on the surface of the semiconductor layer 102a carrier movement layer 107 provided on the pigment adsorption partand a second transparent electrode 108 provided on the carrier movement layer 107.

CLAIMS

[Claim(s)]
[Claim 1]A multicolor dye sensitizing transparent semiconductor electrode member comprising:
A transparent semiconductor layer.

A sensitizing dye adsorption part of a plural color which stuck to two or more parts on said surface of a transparent semiconductor layer.

[Claim 2]The multicolor dye sensitizing transparent semiconductor electrode member according to claim 1wherein two or more color arrangement of said sensitizing dye adsorption part is regularly carried out to said transparent semiconductor layer.
[Claim 3]A multicolor dye sensitizing type solar cell comprising:
The 1st transparent electrode.
A transparent semiconductor layer provided on said 1st transparent electrode.
A sensitizing dye adsorption part of a plural color which stuck to two or more parts on said surface of a transparent semiconductor layer.
The 2nd transparent electrode provided on the career moving bed provided on said sensitizing dye adsorption partand said career moving bed.

[Claim 4]The multicolor dye sensitizing type solar cell according to claim 3wherein two or more color arrangement of said sensitizing dye adsorption part is regularly carried out to said transparent semiconductor layer.
[Claim 5]The multicolor dye sensitizing type solar cell according to claim 3 or 4 characterized by one surface of said 1st transparent electrode and said 2nd transparent electrodeor providing an auxiliary electrode at least into [one] said 1st transparent electrode and said 2nd transparent electrode at least.
[Claim 6]A display devicewherein the multicolor dye sensitizing type solar cell according to claim 4 is a light filter.
[Claim 7]The display device according to claim 6wherein said display device is a high-reflective-liquid-crystal display device.
[Claim 8]A manufacturing method of a multicolor dye sensitizing transparent semiconductor electrode member characterized by comprising the following.
A process of forming a transparent semiconductor on a transparent electrode.
A process which makes sensitizing dye of a plural color stick to two or more parts of said transparent semiconductor surface.
A process of being desorbed from said sensitizing dye of a specific portion of said transparent semiconductor surface by irradiating with ultraviolet rays.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the manufacturing method of a multicolor dye sensitizing transparent semiconductor electrode membera multicolor dye sensitizing type solar cella display deviceand a multicolor dye sensitizing transparent semiconductor electrode member.
[0002]
[Description of the Prior Art]The electric power which drives the display device used for various uses now is supplied by the liquid crystal display elementfor example by the cell formed in the exterior of the liquid crystal display element.
That driving time is restricted by a battery life poses a problem.
In order to lengthen driving timeuse of a solar cell is effectivebut in using a solar cellthere is the necessity of providing the light sensing portion of a solar cell in the exterior of a display deviceand there is a problem that a display device becomes large.
[0003]In order to prevent a display device becoming largethe method of creating a solar cell is also in the inside of a display device. For examplethere is a method of using opaque solar cellssuch as Sifor the shade part of a liquid crystal display element so that it may be indicated to the patent No. 2728041but the shade part cannot secure a large acceptance surface productbut sufficient energy supply is difficult. Or there is also a method of making the light absorption layer of a liquid crystal display element drive this as an energy source using an opaque solar cell so that it may be indicated to JP8-152620Abut since a light absorption layer is under a liquid crystal layerlight is interrupted by the liquid crystal layer and energy supply also with this sufficient is difficult.
[0004]In additionmethods of producing a solar cell inside a display device also include the method of forming the solar cell of a light transmittance state in the display device surface. As a solar cell which has a function which penetrates lightthere are a rear-face transparent electrode solar cell which formed the amorphous-silicon solar cell on the glass substratea see-through solar cella dye sensitizing type solar cell which enable the penetration of light by opening micropore in siliconetc. Since a color is restricted to the band gap of silicon as for a rear electrode solar cellit will become impossible howeverfor

bluegreenetc. to express a display devicefor example except red. Since a see-through solar cell makes a light transmittance state possible by microporeit both cannot take the high transmissivity and energy supply of light.

[0005]A dye sensitizing type solar cell consists of the 1st transparent electrodethe transparent semiconductor formed on itthe sensitizing dye which stuck to the transparent semiconductor surfacea carrier layer on itand the 2nd transparent electrode on a carrier layer as indicatedfor example to the patent No. 2664194. This dye sensitizing type solar cell operates through the following processes.

[0006]If the light which entered reaches sensitizing dye through sensitizing dye or the 2nd transparent electrodeand a carrier layer through the 1st transparent electrode and a transparent semiconductorlight excites this sensitizing dyeand an electron will be produced on a LUMO level and it will produce a hole on a HOMO level. The electron of the LUMO level of the sensitizing dye produced by excitation moves to the conducting zone of a transparent semiconductor promptlyand is crossed to the 1st transparent electrode. The hole which remained in the HOMO level of sensitizing dye receives an electron from the career moving bedand sensitizing dye is neutralized. By having passed the electronthe ion or hole produced in the career moving bed diffuses the inside of the career moving bedreaches the 2nd transparent electrodeand receives an electron from the 2nd transparent electrode. It operates as a dye sensitizing type solar cell by using as an anode the 2nd transparent electrode that passed the negative electrode and the electron for the 1st transparent electrode that received the electron.

[0007]

[Problem(s) to be Solved by the Invention]Howeverin the conventional dye sensitizing type solar cellsince the number of coloring matter was one to one transparent semiconductorappearance had the shape of colored glass of one sheet like the rear-face transparent electrode solar cell. Thereforesince two or more colors cannot be expressedit cannot provide in the inside of a display and does not think other than the use only as a solar cell which absorbs and generates light.

[0008]

[Means for Solving the Problem]Thena multicolor dye sensitizing transparent semiconductor electrode memberwherein this invention comprises a transparent semiconductor layer and a sensitizing dye adsorption part of a plural color which stuck to two or more parts on the surface of a transparent semiconductor layer is provided.

[0009]Two or more color arrangement of the sensitizing dye adsorption

part of this multicolor dye sensitizing transparent semiconductor electrode member may be regularly carried out to a transparent semiconductor layer. A transparent semiconductor layer by which this invention was provided on the 1st transparent electrode and the 1st transparent electrodeA multicolor dye sensitizing type solar cell comprising a sensitizing dye adsorption part of a plural color which stuck to two or more parts on the surface of a transparent semiconductor layerthe career moving bed provided on a sensitizing dye adsorption partand the 2nd transparent electrode provided on the career moving bed is provided.

[0010]Two or more color arrangement of the sensitizing dye adsorption part of this multicolor dye sensitizing type solar cell may be regularly carried out to a transparent semiconductor layer. moreover -- this multicolor dye sensitizing type solar cell -- at least -- one surface of the 1st transparent electrode and the 2nd transparent electrode -- or an auxiliary electrode may be provided into [one] the 1st transparent electrode and the 2nd transparent electrode at least.

[0011]Furthermorethis invention provides a display device in which these multicolor dye sensitizing type solar cells are light filters. This display device may be a high-reflective-liquid-crystal display device.

[0012]A manufacturing method of a multicolor dye sensitizing transparent semiconductor electrode memberwherein this invention is characterized by comprising the following.

A process of forming a transparent semiconductor on a transparent electrode.

A process which makes sensitizing dye of a plural color stick to two or more parts of a transparent semiconductor surface.

A process of being desorbed from sensitizing dye of a specific portion of a transparent semiconductor surface by irradiating with ultraviolet rays.

[0013]

[Embodiment of the Invention]Although the example of this invention is described in detail belowthis invention is not limited to these examples. The 1st example of this invention is described. Using the multicolor dye sensitizing type solar cell of four colors as shown in the lineblock diagram of drawing 1this example produces a light filteras shown in the sectional view of drawing 2and it makes this a liquid crystal display element.

[0014]The multicolor dye sensitizing type solar cell portion of this example like drawing 1 The 1st transparent electrode 101It becomes the

sensitizing dye adsorption parts 103104105and 106 of four colors by which the transparent semiconductor 102 on the 1st transparent electrode 101 and the transparent semiconductor 102 were adsorbed from the career moving bed 107 on itand the 2nd transparent electrode 108 that counters these. The auxiliary electrode 109 is formed on the 1st transparent electrode 101 and the 2nd transparent electrode 108.

[0015]Drawing 2 is the high-reflective-liquid-crystal display device using this multicolor dye sensitizing type solar cell portion as a light filter. On the substrate 201after laminating TFT circuits 202the scatter reflection picture element electrode 203and the liquid crystal layer 204 which exist for every pixelthe common electrode 205 is formed and a multicolor dye sensitizing type solar cell portion like drawing 1 is formed at the top layer. It is also possible to use the 1st transparent electrode 101 or the 2nd transparent electrode 108 as the common electrode 205and the 1st transparent electrode 101 of drawing 1 was used as the common electrode 205 in this example.

[0016]As sensitizing dyethe cyanine yellow sensitizing dye set to n= 0the cyanine magenta sensitizing dye set to n= 1 in drawing 3and the cyanine cyanogen sensitizing dye set to n= 2 in drawing 3 are used in the coloring matter shown in drawing 3. And what mixed cyanine yellow sensitizing dye and cyanine magenta sensitizing dye by the mole ratio of 2:1 is used as red sensitizing dyeUse as green sensitizing dye what mixed cyanine yellow sensitizing dye and cyanine cyanogen sensitizing dye by the mole ratio of 3:1and let what mixed cyanine magenta sensitizing dye and cyanine cyanogen sensitizing dye by the mole ratio of 3:2 be blue sensitizing dye. Let the coloring matter shown by drawing 4 be black sensitizing dye.

[0017]Firstthe manufacturing method of the multicolor dye sensitizing type solar cell portion shown in drawing 1 is described. The about 2 mol/l dissolution of the $TiCl_4$ is carried out into ethanoland the titanium alkoxide containing about 50mg [/ml] titanium is obtained by adding methanol. After hydrolyzing thisit applies on the 1st transparent electrode 101 that vapor-deposited platinum as the auxiliary electrode 109it calcinates for about 30 minutes at about 400 **and a TiO_2 film is obtained as the transparent semiconductor 102. At this timeabout 600 thickness has [about 5 micrometers] preferred specific surface area when a TiO_2 film provides the unevenness to the case where the surface is a flat surface.

[0018]Nextthe obtained TiO_2 film is covered with the mask which carried out the openingand only the red sensitizing dye adsorption part 103 immerses it into the ethanol solution of red sensitizing dye. After

being immersed for about 3 hoursa TiO_2 film is taken outit washes by ethanoland a mask is exfoliated. Nextthe green sensitizing dye adsorption part 104 is immersed into the ethanol solution of green sensitizing dye using the mask which carried out the opening. After being immersed for about 3 hoursa TiO_2 film is taken outit washes by ethanoland a mask is removed. Nextthe blue sensitizing dye adsorption part 105 is immersed in the ethanol solution of blue sensitizing dye using the mask which carried out the opening. After being immersed for about 3 hoursa TiO_2 film is taken outit washes by ethanoland a mask is removed. Thenit is immersed into the ethanol solution of black sensitizing dye for about 3 hoursand washes by ethanol.

[0019]Besides in a layerethylene carbonateand $_4$ (C_3H_7) NI and I_2 equimolar every The electrolysis solution which mixed the included acetonitrile so that it might become about 80% and about 20% by a volume ratiorespectivelyThe polymer beads about 10 micrometers in diameter used as a spacer are put with the 1st transparent electrode 101 that adsorbed the above-mentioned sensitizing dyeand the 2nd transparent electrode 108the side is closed by resinand a multicolor dye sensitizing type solar cell portion is obtained.

[0020]On the other handas shown in drawing 2TFT circuits 202 and the scatter reflection picture element electrode 203 are laminated on the substrate 201. The liquid crystal layer 204 is pinched by using the 1st transparent electrode 101 of this substrate 201 and a multicolor dye sensitizing type solar cell portion as the common electrode 205and the high-reflective-liquid-crystal display device which uses a multicolor dye sensitizing type solar cell portion as a light filter is completed.

[0021]The place which irradiated this high-reflective-liquid-crystal display device with a multicolor dye sensitizing type solar cell with false sunlight by the intensity of about 750 mW/cm^2When it not only can use as a high-reflective-liquid-crystal display devicebut it could use as a solar cell and photoelectric conversion efficiency was searched forabout 6.5% of the energy conversion efficiency was acquired.

[0022]Nextthe 2nd example of this invention is described. Like the 1st exampleusing the multicolor dye sensitizing type solar cell of four colors as shown in the lineblock diagram of drawing 1this example produces a light filteras shown in the sectional view of drawing 5and it makes this an electrochromic display device.

[0023]The multicolor dye sensitizing type solar cell portion of this example is constituted like drawing 1 like Example 1. In drawing 5the same numerals are attached to the portion which is common in drawing 1and the explanation is omitted.

[0024]Drawing 5 is the electrochromic display device using this multicolor dye sensitizing type solar cell portion as a light filter. The counterelectrode 501 is on the 1st transparent substrate 502the electrochromic solution layer 503the display electrode 504 which exists for every pixeland the 2nd transparent substrate 505 are laminatedand an electrochromic display device part is constituted.
[0025]It is connected to the 2nd transparent substrate 505 of this electrochromic display device partand the 1st transparent electrode 101 forms the same multicolor dye sensitizing type solar cell portion as drawing 1 in the top layer. Although the 1st transparent electrode 101 was connected to the 2nd transparent substrate 505 in this exampleit is also possible to connect the 2nd transparent electrode 108.
[0026]Nextthe manufacturing method of this electrochromic display device is described. The manufacturing method of the TiO_2 film as the sensitizing dye of the multicolor dye sensitizing type solar cell portion of this example and the transparent semiconductor 102 on the 1st transparent electrode 101 is the same as that of Example 1.
[0027]Thenthe obtained TiO_2 film is immersed into the ethanol solution of red sensitizing dye. The back TiO_2 film made immersed for about 1 hour is taken outa mask is put on the red sensitizing dye adsorption part 103 after washing by ethanoland it irradiates with ultraviolet rays with a wavelength of about 200 nm for about 30 minutes. Thenit washes by ethanol. Nextit is immersed into the ethanol solution of green sensitizing dye. The back TiO_2 film made immersed for about 1 hour is taken outa mask is put on the green sensitizing dye adsorption part 104 after washing by ethanoland it irradiates with ultraviolet rays with a wavelength of about 200 nm for about 30 minutes. Thenit washes by ethanol. Nextit is immersed into the ethanol solution of blue sensitizing dye. The back TiO_2 film made immersed for about 1 hour is taken outa mask is put on the blue sensitizing dye adsorption part 105 after washing by ethanoland it irradiates with ultraviolet rays with a wavelength of about 200 nm for about 30 minutes. A mask is removed after that and it washes by ethanol. Nextit is immersed into the ethanol solution of black sensitizing dye for about 3 hoursand washes by ethanol. It produces like Example 1 and a multicolor dye sensitizing type solar cell portion is obtained.
[0028]On the 1st transparent substrate 502 that used this multicolor dye sensitizing type solar cell portion as the light filterand formed the counterelectrode 501After laminating the electrochromic solution layer 503the display electrode 504and the 2nd transparent substrate 505on itthe 1st transparent electrode 101 of a multicolor dye sensitizing type

solar cell portion is connectedand an electrochromic display device is completed.

[0029]The place which irradiated this electrochromic display device with a multicolor dye sensitizing type solar cell with false sunlight by the intensity of about 750 mW/cm^{2}When it not only can use as an electrochromic display devicebut it could use as a solar cell and photoelectric conversion efficiency was searched forabout 6.5% of the energy conversion efficiency was acquired.

[0030]Nextthe 3rd example of this invention is described. This example produces illustrated glass as shown in drawing 6 using the multicolor dye sensitizing type solar cell of two colors.

[0031]The multicolor dye sensitizing type solar cell portion of this example produces and comprises the same method as Example 1. Howeverthe pattern of sensitizing dye is made to adsorb each sensitizing dye at the pattern 601 and the background 602 using a mask unlike Example 1. In this examplethe red sensitizing dye of Example 1 was used for the pattern 601and the blue sensitizing dye of Example 1 was used for the background 602. Since it does not have a portion which does not let light passthe auxiliary electrode 109 is not used.

[0032]When this illustrated glass with a multicolor dye sensitizing type solar cell was irradiated with false sunlight by the intensity of about 750 mW/cm^{2}it could use as a solar celland when photoelectric conversion efficiency was searched forabout 6.5% of the energy conversion efficiency was acquired.

[0033]In the old displaya part of light energy was absorbed by the light filterand it was changed into heat. Howeverby using the multicolor dye sensitizing type solar cell of this invention as a light filterphotoelectric conversion of the light energy currently changed into heat can be carried outand electric power can be supplied. As a displaydisplay devicessuch as an electrochromic display device as shown not only in a liquid crystal display element but in JP6-250233Aan EL displaya plasma displaya display using a cathode-ray tubecan also be used.

[0034]With the multicolor dye sensitizing type solar cell of this inventionpatternssuch as a picture and a charactercan be allotted to glass etc. and it can also use as the window which can supply electric powera signboarda containeretc.

[0035]The transparent electrode used by this invention may comprise two-layer [by which the transparent conductive layer was provided in the transparent substrate surface]. In that caseas a transparent substratethere are glassa polymer filmetc. and tin oxidea zinc oxideetc.

which doped fluorideindiumaluminumetc. are preferred as a transparent conductive layer. Opaque metal layerssuch as platinum and gold minute amount [grade / which seldom interrupts light transmission]silvercopperand aluminummay be contained in the transparent conductive layer.

[0036]The anode of a multicolor dye sensitizing type solar cell and the negative electrode use the transparent electrodeand constitute the transparent electrode from an example of this invention by two-layer [of a transparent substrate and a transparent conductive layer]. Howeveras for the conductivity of the transparent conductive layer used for a transparent electrodeconversion efficiency will fall well [so]. Thereforeconversion efficiency can also be raised by providing an auxiliary electrode.

[0037]For examplewhen arranging redblueand four green and black colors to a transparent semiconductor surfacethe black portion is effective in order for there to be almost no influence in appearance and to raise conversion efficiencyeven if it provides the auxiliary electrode which changes from opaque metal etc. to the black portionin order to hardly penetrate light.

[0038]When a transparent electrode is constituted from two-layer [of a transparent substrate and a transparent conductive layer] between a transparent semiconductor and a transparent electrodethe position of an auxiliary electrode a negative electrodeBetween the transparent conductive layer in a transparent electrode and transparent substrates is preferredand when an anode constitutes an electrode surface or a transparent electrode from two-layer [of a transparent substrate and a transparent conductive layer]between a transparent conductive layer and transparent substrates is preferred in a transparent electrode.

[0039]As a material of an auxiliary electrodemetalsuch as platinumgoldsilvercopperand aluminumand conductive high materialssuch as graphiteare desirable. The sensitizing dye excited by light produces an electron on a LUMO leveland produces a hole on a HOMO level. The electron of the LUMO level of the sensitizing dye produced by excitation moves to the conducting zone of a transparent semiconductor promptlyand is crossed to the 1st transparent electrode. Since the hole remains in the HOMO level of sensitizing dye at this timethe career moving bed is just the material containing a career with the work which neutralizes this holeand an electronor a hole or ion may be sufficient as the kind of career.

[0040]As the career moving beda liquid material or a solid material may be sufficient. As a liquid materialacetonitrile / ethylene carbonate

mixed solvent electrolytic solution which comprises about 0.03 mol/l. of iodinefor example with iodination tetrapropylammonium about 0.5 mol/land potassium iodide about 0.02 mol/l may be sufficient.

[0041]As a solid materiala solid ion migration material and solid hole or electronic transition material is preferred. As a solid ion migration materialfor example Acetonitrile and ethylene carbonateInto propylene carbonate or these mixturespolyethylene oxidePolyacrylonitrilepolyvinylidene fluoridepolyvinyl alcoholThe gel electrolyte which mixed and polymerized host polymersuch as polyacrylic acid and polyacrylamideThe solid electrolyte etc. which have saltssuch as a sulfonimide saltalkyl imidazolium salta tetracyano quinodimethane salta dicyano kino diimine saltin polymers side chainssuch as polyethylene oxide or polyethylenecan also be used.

[0042]As a solid hole or an electronic transition materialthe organic molecule of crystallinity or amorphous nature can be used. As a thing with crystallinityelectron donor acceptor complexessuch as polycyclic aromaticssuch as perylene and coronenevarious metal-phthalocyanines and perylene tetracarboxylic acid and tetrathiafulvalenetetracyano quinodimethaneetc. may be used.

[0043]As an amorphous materialthe aluminum quinodimethane shown by drawing 7the diamine shown by drawing 8the various oxadiazole shown by drawing 9other polypyrrolepoly anilinepoly-N-vinylcarbazolepolyphenylene vinyleneetc. may be used.

[0044]Sensitizing dye will absorb incident lightand will be in an excitation statean electron is passed to a transparent semiconductorand a hole is neutralized by the career moving bed after that. Thereforethe LUMO level of sensitizing dye is the same as the conducting-zone level of a transparent semiconductoror has the necessity of being above itand the HOMO level of sensitizing dye is the same as the valence band level of the career moving bedor the oxidation-reduction potential of ionor needs to be below it.

[0045]It is desirable for sensitizing dye just to have an adsorption site for adsorbing to a transparent semiconductor stronglyand to have functional groupssuch as a carboxyl groupa hydroxyalkyl grouphydroxyla sulfone groupa carboxy alkyl groupin a molecule.

[0046]And ruthenium trisa ruthenium screwosmium trisAn osmium screw type transition metal complexand a polynuclear complexa ruthenium SHISUJI Aqua bipyridyl complexIt is preferred that it is the structure which had a functional group in the last paragraph in phthalocyanine dyeporphyrin dyeperylene coloring matteran anthraquinone pigmentazo dyekino FUTARON coloring matternaphthoquinone coloring mattercyanine dyemerocyanine

dyeetc.
[0047]The coloring matter which sticks to each part of a transparent semiconductor as one color may comprise one kindand in order to acquire the color for which it asksthe transparent semiconductor surface may be adsorbed in the mixture of two or more coloring matter.
[0048]**** for what colors of a color is also goodand the several colors of them do not need to contribute to photoelectric conversion as sensitizing dye. Howeverat least two or more colors in the color used need to contribute to the photoelectric conversion function as sensitizing dye.
[0049]Adsorption to the transparent semiconductor of coloring matter can be performed by immersing a transparent semiconductor into the solvent which coloring matter is dissolvingand can also heat a solvent in that case. In order to acquire the color for which it askswhen making two or more kinds of coloring matter stick to the same placethe solution of the mixture of those coloring matter may be used.
[0050]What is necessary is just to form the mask used in the control method of the place the coloring matter adsorption to the transparent semiconductor surface of this invention with the photolithographic method etc. In Example 2when carrying out decomposition removal of the coloring matter by UV irradiationthe light which focused using the lens etc. and the method of scanning a substrate top by a laser beam may be used for UV irradiation.
[0051]The material used as a transparent semiconductor is a semiconductor with little optical absorption of a light rangeIn a metal oxide semiconductorthe oxide of a transition metalfor exampletitaniuma zirconiumOxidessuch as hafniumstrontiumzincindiumyttriuma lanternvanadiumniobiumtantalumchromiummolybdenumand tungstenand these multiple oxidesor an oxide mixture is preferred. Perovskites like $SrTiO_3$$CaTiO_3$$BaTiO_3$$MgTiO_3$and $SrNb_2O_6$these multiple oxides or an oxide mixtureGaNetc. may be sufficient.
[0052]As for the adsorption to the transparent semiconductor surface of sensitizing dyemore than the thickness about a number molecular layer does not take place. Thereforein order to adjust the thickness of a colordetailed unevenness can be provided in a transparent semiconductor surfaceeffectual surface area can be adjustedand the amount of adsorption per unit area of sensitizing dye can also be controlled. Particle structure can be used as rugged structure. For examplewhen producing the fine structure using the sintered compact of a TiO_2 particle with a particle diameter of about 10 nmeffectual surface area can be controlled by adjusting the thickness of a particle layer.

[0053]When making sensitizing dye stick to a transparent semiconductorcoloring matter moves in the inside of the transparent semiconductor under a maskand in order to prevent coloring matter oozing out on the outside of a mask patternin a transparent semiconductora separator material may be included in a randomness or predetermined pattern.

[0054]

[Effect of the Invention]As mentioned aboveby according to the multicolor dye sensitizing type solar cell of this inventionobtaining a light filter with a photoelectric conversion functionand using this in a display as a driving source of a displayThe electric power supplied from a power supply can be reduced without providing auxiliary powersuch as a solar cellin the exterior of a displayand energy saving of a device can be attained. Since this light filter with a photoelectric conversion function serves as the composition of replacing the conventional light filter and it carries out photoelectric conversion of the light energy which the conventional light filter absorbed and was being changed into heatElectric power can be supplied without spoiling the luminosity and color reproduction nature of a screen compared with the conventional colored presentation panel. It can use as a windowa signboarda containeretc. into which informationincluding the colored glass of a multicolor patterna picturea characteretc. with the added value of photoelectric conversion went with the multicolor dye sensitizing type solar cell of this invention.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The lineblock diagram of the multicolor dye sensitizing type solar cell of this invention.

[Drawing 2]The sectional view of a high-reflective-liquid-crystal display device using the multicolor dye sensitizing type solar cell of this invention.

[Drawing 3]The chemical formula of the sensitizing dye concerning the example of this invention.

[Drawing 4]The chemical formula of black sensitizing dye.

[Drawing 5]The sectional view of an electrochromic display device using the multicolor dye sensitizing type solar cell of this invention.

[Drawing 6]The figure explaining the illustrated glass using the multicolor dye sensitizing type solar cell of this invention.

[Drawing 7]The chemical formula of aluminum quinodimethane.
[Drawing 8]The chemical formula of diamine.
[Drawing 9]The chemical formula of various oxadiazole.
[Description of Notations]
101 -- The 1st transparent electrode
102 -- Transparent semiconductor layer
103 -- Red sensitizing dye adsorption part
104 -- Green sensitizing dye adsorption part
105 -- Blue sensitizing dye adsorption part
106 -- Black sensitizing dye adsorption part
107 -- Career moving bed
108 -- The 2nd transparent electrode
109 -- Auxiliary electrode
201 -- Substrate
202 -- TFT circuits
203 -- Scatter reflection picture element electrode
204 -- Liquid crystal layer
205 -- Common electrode
501 -- Counterelectrode
502 -- The 1st transparent substrate
503 -- Electrochromic solution layer
504 -- Display electrode
505 -- The 2nd transparent substrate
601 -- Pattern
602 -- Background